

WHAT IS CLAIMED IS:

1 1. A data communication system comprising a data
2 transmitter, a data receiver, and a network for connecting the
3 data transmitter to the data receiver, wherein said data
4 transmitter transmits data packets to the data receiver, said
5 data receiver transmits an ACK packet for informing the data
6 transmitter of the confirmation of the delivery of the received
7 data packet, and said data transmitter detects the loss of the
8 transmitted data packet based on the content of the ACK packet
9 and retransmits the data packet, which has been detected to be
10 lost, whereby error control of data packets is carried out,

11 said data transmitter comprising:

12 a counter for counting the number of round trips of data
13 packets transmitted; and

14 means for storing, for each transmitted data packet, the
15 relationship between the data packet and the counter value at
16 the time of the transmission of the data packet and, when the
17 stored counter value is two or more smaller than the current
18 counter value, judges that the data packet corresponding to the
19 stored counter value has been lost, followed by the
20 retransmission of the data packet which has been judged to be
21 lost.

1 2. The data communication system according to claim 1,
2 wherein

3 the data transmitter further comprises means for
4 incorporating, as round trip notification information, the

5 current counter value into the data packet transmitted,
6 the data receiver further comprises means for
7 incorporating, as round trip response information, the counter
8 value, contained as the round trip notification information in
9 the received data packet, into an ACK packet for the received
10 data packet, and

11 the data transmitter further comprises means for
12 increasing the counter value by one in the case where the value
13 contained as the round trip response information in the
14 received ACK packet is equal to said counter value.

15 3. A data communication system comprising a data
16 transmitter, a data receiver, and a network for connecting the
17 data transmitter to the data receiver, wherein said data
18 transmitter transmits data packets to the data receiver, said
19 data receiver transmits an ACK packet for informing the data
20 transmitter of the confirmation of the delivery of the received
21 data packet, and said data transmitter detects the loss of the
22 transmitted data packet based on the content of the ACK packet
23 and retransmits the data packet, which has been detected to be
24 lost, whereby error control of data packets is carried out,

25 said data transmitter comprising:

26 a counter for counting the number of round trips of data
27 packets transmitted;

28 first and second tables for storing predetermined data;

29 means for storing, for each transmitted data packet, the
30 relationship between the data packet and the time at the point
31 of the transmission of the data packet in the first table;

18 means for storing, in the second table, for each counter
19 value in the counter, the relationship between the counter
20 value and the time at the point of the transmission of the
21 first data packet after the counter has indicated said counter
22 value; and

23 means which, when the value of the time stored in the
24 first table is smaller than the value of the time corresponding
25 to a counter value which is two smaller than the current
26 counter value stored in the second table, judges that the data
27 packet corresponding to the time stored in the first table has
28 been lost, followed by the retransmission of the data packet
29 which has been judged to be lost.

30 4. The data communication system according to claim 3,
31 wherein

32 the data transmitter further comprises means for
33 incorporating, as time notification information, the current
34 time into the data packet transmitted,

35 the data receiver further comprises means for
36 incorporating, as time response information, the time,
37 contained as the time notification information in the received
38 data packet, into an ACK packet for the received data packet,
39 and

40 the data transmitter further comprises means for
41 increasing the counter value by one in the case where the time
42 contained as the time response information in the received ACK
43 packet is equal to or larger than the current time value stored,
44 in the second table, in the relationship with the current
45

16 counter value.

1 5. A data communication system comprising a data
2 transmitter, a data receiver, and a network for connecting the
3 data transmitter to the data receiver, wherein said data
4 transmitter transmits data packets to the data receiver, said
5 data receiver transmits an ACK packet for informing the data
6 transmitter of the confirmation of the delivery of the received
7 data packet, and said data transmitter detects the loss of the
8 transmitted data packet based on the content of the ACK packet
9 and retransmits the data packet, which has been detected to be
10 lost, whereby error control of data packets is carried out and,
11 wherein, during error control in its period between the
12 detection of the loss of a data packet and the confirmation of
13 the delivery of the data packet by the data transmitter,
14 transmission flow control is carried out by a transmission
15 window,

16 said data transmitter functioning to release, from the
17 transmission window, a closed window to an extent corresponding
18 to the total size of data, for which delivery confirmation has
19 been newly made by ACK packets received from the data receiver
20 during the error control, thereby rendering the released window
21 transmittable.

1 6. A data communication method comprising the steps of:
2 providing a data communication system comprising a data
3 transmitter, a data receiver, and a network for connecting the
4 data transmitter to the data receiver; transmitting data

5 packets by the data transmitter to the data receiver;
6 transmitting an ACK packet for informing, by the data receiver,
7 the data transmitter of the confirmation of the delivery of the
8 received data packet; detecting the loss of the transmitted
9 data packet, by the data transmitter, based on the content of
10 the ACK packet; and retransmitting the data packet, which has
11 been detected to be lost, by the data transmitter, thereby
12 performing error control of data packets, wherein

13 the data transmitter is provided with a counter for
14 counting the number of round trips of data packets transmitted,
15 and

16 for each transmitted data packet, the relationship
17 between the data packet and the counter value at the point of
18 the transmission of the data packet is stored, and, when the
19 stored counter value is two or more smaller than the current
20 counter value at that time, the data packet corresponding to
21 the stored counter value is regarded as having been lost,
22 followed by the retransmission of the lost data packet.

1 7. The data communication method according to claim 6,
2 wherein

3 the data transmitter incorporates, as round trip
4 notification information, the current counter value into the
5 data packet transmitted,

6 the data receiver incorporates, as round trip response
7 information, the counter value, contained as the round trip
8 notification information in the received data packet, into an
9 ACK packet for the received data packet, and

10 the data transmitter increases the counter value by one
11 in the case where the value contained as the round trip
12 response information in the received ACK packet is equal to
13 said counter value.

1 8. A data communication method comprising the steps of:
2 providing a data communication system comprising a data
3 transmitter, a data receiver, and a network for connecting the
4 data transmitter to the data receiver; transmitting data
5 packets by the data transmitter to the data receiver;
6 transmitting, by the data receiver, an ACK packet for informing
7 the data transmitter of the confirmation of the delivery of the
8 received data packet; detecting the loss of the transmitted
9 data packet, by the data transmitter, based on the content of
10 the ACK packet; and retransmitting the data packet, which has
11 been detected to be lost, by the data transmitter, thereby
12 performing error control of data packets, wherein

13 the data transmitter is provided with a counter for
14 counting the number of round trips of data packets transmitted,
15 and first and second tables for storing predetermined data,
16 for each transmitted data packet, the relationship between the
17 data packet and the time at the point of the transmission of
18 the data packet is stored in the first table,

19 for each counter value in the counter, the relationship
20 between the counter value and the time at the point of the
21 transmission of the first data packet after the counter has
22 indicated said counter value is stored in the second table, and

23 when the value of the time stored in the first table is

24 smaller than the value of the time corresponding to a counter
25 value which is two smaller than the current counter value
26 stored in the second table, the data packet corresponding to
27 the time stored in the first table is regarded as having been
28 lost, followed by the retransmission of the data packet which
29 has been judged to be lost.

1 9. The data communication method according to claim 8,
2 wherein

3 the data transmitter incorporates, as time notification
4 information, the time at that point into the data packet
5 transmitted,

6 the data receiver incorporates, as time response
7 information, the time, contained as the time notification
8 information in the received data packet, into an ACK packet for
9 the received data packet, and

10 the data transmitter increases the counter value by one
11 in the case where the time contained as the time response
12 information in the received ACK packet is equal to or larger
13 than the time stored in the relationship with the current
14 counter value stored in the second table.

1 10. A data communication method comprising the steps of:
2 providing a data communication system comprising a data
3 transmitter, a data receiver, and a network for connecting the
4 data transmitter to the data receiver; transmitting data
5 packets by the data transmitter to the data receiver;
6 transmitting, by the data receiver, an ACK packet for informing

7 the data transmitter of the confirmation of the delivery of the
8 received data packet; detecting the loss of the transmitted
9 data packet, by the data transmitter, based on the content of
10 the ACK packet; retransmitting the data packet, which has been
11 detected to be lost, by the data transmitter, thereby
12 performing error control of data packets; and performing
13 transmission flow control by a transmission window, during
14 error control in its period between the detection of the loss
15 of a data packet and the confirmation of the delivery of the
16 data packet by the data transmitter, wherein

17 the data transmitter functions to release, from the
18 transmission window, a closed window to an extent corresponding
19 to the total size of data, for which delivery confirmation has
20 been newly made by ACK packets received from the data receiver
21 during the error control, and consequently renders the released
22 window transmittable.

1 11. A computer readable recording medium comprising,
2 recorded thereon, a program which is used in executing the data
3 communication method according to any one of claims 6 to 10 by
4 means of a computer.